# Quantitative data analysis of perceived barriers and motivators to physical activity in stroke survivors

J R Coll Physicians Edinb 2017; 47: 231–6 | doi: 10.4997/JRCPE.2017.304 PAPER

# Quantitative data analysis of perceived barriers and motivators to physical activity in stroke survivors

SL Nicholson[1], CA Greig[2], F Sniehotta[3], M Johnston[4], SJ Lewis[5], MET McMurdo[6], D Johnston[7], J Scopes[8], GE Mead[9]

**Abstract**

**Background** Levels of physical activity after stroke are low, despite multiple health benefits. We explored stroke survivors' perceived barriers, motivators, self-efficacy and intention to physical activity.

**Methods** Fifty independently mobile stroke survivors were recruited prior to hospital discharge. Participants rated nine possible motivators and four possible barriers based on the Mutrie Scale, as having 'no influence', 'some influence' or 'a major influence' on physical activity. Participants also rated their self-efficacy and intention to increasing walking.

**Results** The most common motivator was 'physical activity is good for health' [34 (68%)]. The most common barrier was 'feeling too tired' [24 (48%)]. Intention and self-efficacy were high. Self-efficacy was graded as either 4 or 5 (highly confident) on a five-point scale by [34 (68%)] participants, while 42 (84%) 'strongly agreed' or 'agreed' that they intended to increase their walking.

**Conclusion** Participants felt capable of increasing physical activity but fatigue was often perceived as a barrier to physical activity. This needs to be considered when encouraging stroke survivors to be more active.

**Correspondence to:**
S Nicholson
Physical Activity for Health Research Centre
University of Edinburgh
St Leonards Land
Holyrood Road
Edinburgh EH8 9JX
UK

**Email:**
sarah.nicholson@ed.ac.uk

**Keywords:** barrier, motivator, physical activity, self-efficacy, stroke

**Declaration of interests:** No conflict of interests declared

## Introduction

Stroke affects 17 million individuals annually and is the largest cause of disability globally.[1] In the UK over a third of stroke survivors will be dependent on others; of those, one in five will be cared for by a family member.[2]

Physical activity is defined as 'any bodily movement produced by skeletal muscles that results in energy expenditure'.[3] Physical fitness is defined as 'a set of attributes that people have or achieve that relates to the ability to perform physical activity'.[3] After stroke, both physical activity[4,5] and physical fitness[6] are low, and impaired physical fitness is associated with activity limitations.[6] Low physical activity and physical fitness are risk factors for a first ever stroke.[7] Risk modelling studies suggest that the risk of repeated stroke could be reduced by approximately 20% if physical activity is undertaken.[8] Even after minor stroke, physical activity is below what is observed in healthy older adults and other patient populations.[9] Several randomised controlled trials have demonstrated the benefits of physical activity after stroke in increasing physical function and improving fitness.[10–13] A recently updated Cochrane Review showed cardiorespiratory training, including walking, reduces disability, dependence on others during ambulation and improves walking speed in stroke survivors.[6] Consequently, physical activity is recommended for stroke survivors in several national clinical guidelines, including guidelines from the American Heart Association and Scottish Intercollegiate Guidelines Network.[14,15] However, not all stroke survivors wish to participate in structured exercise programmes[11] and fewer than 30% of stroke survivors will undertake the minimum recommendations of physical activity.[16] Therefore, approaches to facilitate uptake and long-term maintenance of physical activity after stroke are required.

[1]Research Assistant, Physical Activity for Health Research Centre, University of Edinburgh, Edinburgh; [2]Senior Lecturer, School of Sport, Exercise and Rehabilitation Sciences, University of Birmingham, Birmingham; [3]Professor, Behaviour Medicine & Health Psychology, Institute of Health & Society, Newcastle University, Newcastle; [4,7]Emeritus Professor, Health Psychology, University of Aberdeen, Aberdeen; [5]Research Fellow, [9]Professor of Stroke and Elderly Care Medicine, School of Clinical Sciences and Community Health, University of Edinburgh, Edinburgh; [6]Professor and Head of Ageing and Health, University of Dundee, Dundee; [8]Physiotherapist, Astley Ainslie Hospital, Edinburgh, UK

A recent systematic review detailed interventions that promote long-term participation in physical activity after stroke.[17] This review investigated measures including frequency, duration and intensity of physical activity at three months or longer in community-dwelling stroke survivors.[17] Results showed tailored counselling alone or with tailored supervised exercise improved long-term physical activity participation and functional exercise capacity after stroke more than tailored supervised exercise with general advice only.[17] To determine the content of 'tailored counselling' for stroke survivors it is essential to understand what prevents physical activity uptake after stroke. A systematic review of the perceived barriers and motivators to physical activity post stroke found this to be an understudied area of research.[18] Only six papers were included in this review, providing information on 174 stroke survivors who were at least six months post stroke. The most commonly reported perceived motivator to physical activity was the possibility of meeting other people with stroke which provided both psychological and social support for participants. The most commonly reported barriers were environmental (access/transport/costs), health problems or stroke-related impairments discouraging activity, embarrassment and fear of recurrent strokes.[18] The perceived barriers identified in this systematic review included those likely to reduce self-efficacy, i.e. individuals' beliefs that they can engage in the activity. In social cognitive theory,[19] control beliefs are conceptualised as self-efficacy, defined in terms of beliefs about capabilities to execute behaviours. Evidence suggests that the extent of self-efficacy towards walking after stroke can be a long term predictor of physical activity.[20] In studies of stroke patients, self-efficacy predicts who will show the greatest improvements in mobility, controlling for actual severity of physical impairment.[21,22] Therefore self-efficacy may play an important role in enabling or preventing stroke survivors performing physical activity.

The aim of the current study was to explore stroke survivors' perceived barriers and motivators to increasing physical activity upon discharge from hospital after acute stroke. The study also aimed to determine self-efficacy and intention to increase walking upon discharge from hospital. Within group comparisons were performed to determine if two walk tests influenced self-efficacy and intention to walk after discharge from hospital. This study was part of a programme of research with the overarching aim of developing a behaviour change intervention to increase physical activity after stroke.

## Methods

Stroke survivors were recruited from hospital acute stroke units to a study that assessed the feasibility and acceptability of pedometers in detecting step counts.[23] As part of this study, participants were asked about their perceived barriers, motivators, self-efficacy and intention towards physical activity. This current paper reports the data on barriers, motivators, self-efficacy and intention to physical activity. Data on the validity and feasibility of pedometers have been reported previously.[23] Ethical approval for the study was obtained from South East Scotland Research Ethics Committee 01.

### Participants

We recruited 50 participants admitted with an acute stroke (first-ever or recurrent) who were ready for discharge from six stroke units in Edinburgh and the Lothians (two acute, three rehabilitation and one mixed rehabilitation/acute unit). Potential participants were identified in consultation with clinical teams, between 27/10/2009 and 15/04/2010.

Patients were included in the study if they were independently ambulatory, with or without walking aids, and able to give informed consent. Patients were excluded if they were medically unstable (as identified by Mead et al.[11]) and therefore unable to perform the walking tests safely.

Data on stroke subtype were extracted from the case notes of each participant. A Barthel Score,[24] Rankin Score,[25] participant age at time of stroke, the presence of neurological deficits (including hemiparesis, visual field deficits and speech problems) and the time since stroke for each participant were obtained through scrutiny of notes and discussions between the research assistant and the clinical teams.

### The walks

Participants completed two walks (a 6-minute walk test and a 'short walk') with three pedometers attached to varying locations. These walks were conducted to determine the accuracy of the pedometers, and this has been previously described in detail.[23]

### Barriers and motivators to physical activity

After completing the walking tests, participants were asked to rate four possible barriers and nine possible motivating factors to participating in physical activity after stroke. These potential motivators were based on the Mutrie Scale.[26] This has previously successfully been used to rate barriers and motivators to physical activity in older individuals.[27] The measure was chosen due to its simplicity in measuring perceived barriers and motivators to physical activity. Participants rated the potential barriers and motivators as either 'no influence,' 'some influence' or a 'major influence' to participating in physical activity post stroke.

The motivating factors participants were asked to rate were: 'If the doctor told me to exercise'; The belief that exercise is good for my health'; 'To become fitter'; 'To feel in good shape mentally'; 'To help clear my head'; 'To get rid of tension and stress'; 'To feel in good shape physically'; 'To relax and forget about my cares'; 'To improve or learn new skills'.

The possible barriers to physical activity were: 'Poor health'; 'Feeling too tired'; 'Fear of getting injured or damaging my health'; 'Any injuries or disabilities I already have'.

### Self-efficacy and intention to walking

To determine participants' self-efficacy and intention to

walking at the point of discharge from hospital, they were asked the following two statements and rated their answers to each statement on two separate 5-point rating scales.

To determine self-efficacy to walking participants were asked 'How confident are you that you will be able to increase your walking over the next month? Participants answered this question on a scale of 1–5, where 5 was the most confident and 1 the least confident at being able to increase walking over the next month.

To determine intention to walking participants were asked how much they agreed with the statement 'I intend or plan to walk more over the next month'. The intention statement was graded 1–5 with 1 indicating the participant 'strongly disagreed' with the statement and 5 indicating the participant 'strongly agreed'.

To determine if the walks influenced participants' self-efficacy and intention, participants were randomised into two groups using computer-generated random numbers placed in opaque envelopes. Those randomised to group 1 were asked self-efficacy and intention questions both before and after the two walks, while those randomised to group 2 were asked these questions only after the two walks were completed. This was to explore whether the experience of performing a challenging walking test altered a) self-efficacy about walking and b) intention to increase walking. The inclusion of group 2 would also allow comparison of after data from the two groups, to determine if those who were primed to think about self-efficacy and intention prior to the walk (group 1) were more likely to be confident in their ability to walk more when home from hospital.

## Results

Table 1 gives the demographics for the study participants. In total, 67 stroke survivors were approached to take part in the study, of whom 17 declined. Fifty participants [(29/50) 58% female] undertook the walking tests, of whom 47/50 could be interviewed on barriers and motivators to physical activity (two participants with expressive dysphasia and one with profound deafness could not answer the questions). Forty-nine participants were able to answer the self-efficacy and intention questions. Participant average age was 72.4 yrs (standard deviation: 12.3 yrs); 46 participants had had an ischaemic stroke. The median time since stroke for participants participating in the study was 12.5 days (interquartile range: 6.25–34 days).

**Table 1** Participant demographics

| Demographic variables | No. of patients (%) |
|---|---|
| Total | 50 (100) |
| Gender: | |
| Male | 21 (42) |
| Female | 29 (58) |
| Age (mean, SD) | 72.4 (SD 12.3) |
| Pathology: | |
| Haemorrhagic | 4 (8) |
| Ischaemic | 46 (92) |
| Oxford Community Stroke Project Classification: | |
| • Total Anterior Circulation Stroke | 5 (10) |
| • Partial Anterior Circulation Stroke | 26 (51) |
| • Lacunar stroke syndrome | 8 (16) |
| • Posterior Circulation Stroke | 5 (10) |
| | 6 unknown |
| Side of brain lesion: | |
| Left | 25 (49) |
| Right | 24 (47) |
| Both | 1 (2) |
| Time since stroke (days), (median, IQR) | 12.5, 6.25–34 |
| Barthel Score, (median, IQR) | 100, 90–100 |
| Rankin Score, (median, IQR) | 2,1–3 |

## Motivators

Figures 1 and 2 show the responses from the 47 participants who were interviewed on perceived barriers and motivators to physical activity after stroke. The belief that 'exercise is good for your health' was the perceived motivator most commonly reported as a 'major influence' to encourage physical activity [33/47 (70.2%)]. 'To become fitter' [31/47 (66%)], 'to feel in good shape mentally' [27/47 (57%)] and 'to feel in good shape physically' [26/47 (55%)] were the next most commonly perceived 'major influence' motivators to encourage physical activity. The motivators that were most commonly reported as 'no influence' to the uptake of physical activity included 'to improve/learn new skills' [23/47 (49%)], 'to relax and forget about your cares' [16/47 (34%)] and 'to get rid of stress or tension' [16/47 (34%)].

## Barriers

'Poor health' [23/47 (49%)] was the most commonly reported barrier as a 'major influence' on preventing the uptake of physical activity. 'Poor health' was followed closely by the perceived barrier of feeling 'too tired' [21/47 (45%)]. Participants fearing they 'might get injured or damage health' while taking part in physical activity was only reported by 10/47 (21%) participants as a 'major influence' in preventing physical activity. Furthermore, 31/47 (66%) reported 'might get injured or damage health' as 'no influence' on preventing their uptake of physical activity. Similarly only 7/47 (15%) reported 'an injury or disability' would have a 'major influence' on preventing them from being physically active, while 26/47 (55%) said it would have 'no influence'.

## Self-efficacy and intention

Table 2 shows the responses to the self-efficacy and intention

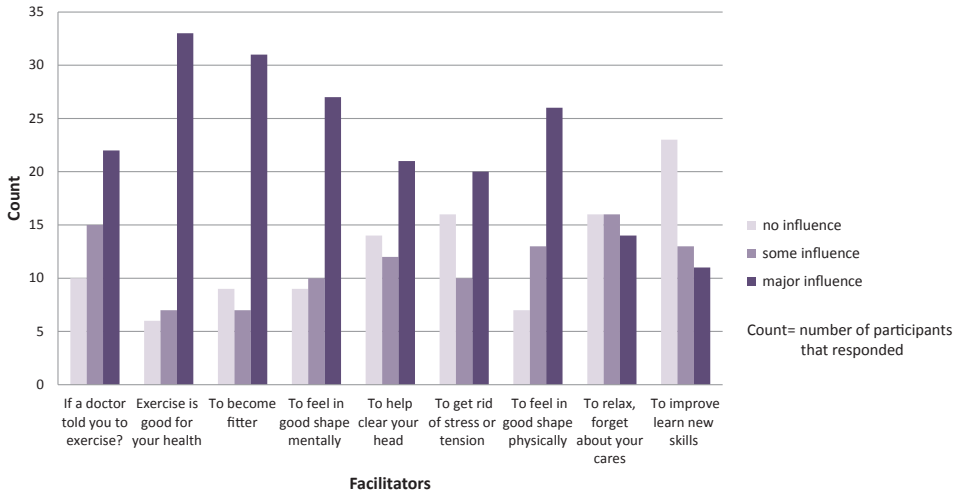


**Figure 1** Perceived facilitators to physical activity

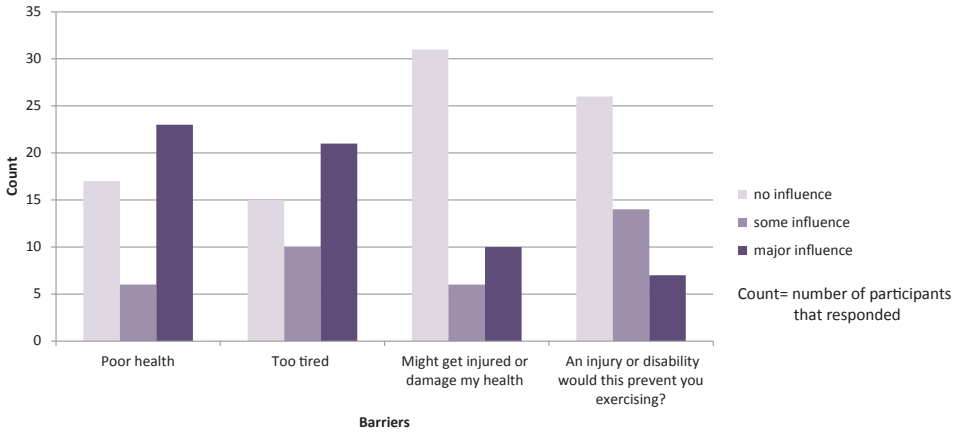


**Figure 2** Perceived barriers to physical activity

statements. Data for one participant were not recorded due to their expressive dysphasia. Both self-efficacy and intention were high in both groups of participants. Three participants reported they did not intend to walk more in the next month, and only marked themselves at the lowest point on the self-efficacy scale. Mann-Whitney U tests were performed to compare the 'after' answers in the two groups; there was no significant difference between scores for self-efficacy ($p = 0.59$) or intention ($p = 0.84$). Similarly, no significant difference was found between the 'before' and 'after' scores for self-efficacy ($p = 0.77$) or intention ($p = 0.16$) for group 1. There was also no significant difference between the 'before' scores for group 1 and the 'after' scores for group 2; self-efficacy ($p = 0.78$) or intention ($p = 0.64$).

## Discussion

### Key findings

Results show that both self-efficacy and intention to physical activity were high prior to discharge from hospital, and these were not affected by performing the walking tests. Participants stated that they were confident about increasing their physical activity, and intended to do so upon discharge from hospital.

The belief that 'exercise is good for your health' was the perceived motivator most commonly reported as a 'major influence' to encourage physical activity [33/47 (70.2%)]. 'To become fitter' [31/47 (66%)], 'to feel in good shape mentally' [27/47 (57%)] and 'to feel in good shape physically' [26/47 (55%)] were the next most commonly perceived 'major influence' motivators. 'Poor health' [23/47 (49%)] was the most commonly reported barrier as a 'major influence' on preventing the uptake of physical activity. Poor health was also found to be a major barrier in community dwelling older adults [28]. Feeling 'too tired' [21/47 (45%)] was also a commonly reported barrier. Fatigue is a common complication post stroke; a systematic review of longitudinal studies demonstrated that the frequency of fatigue is between 35%–92% and can be persistent symptom for at least 36 months after stroke.[29] A recent systematic review including 19 papers (2,072 stroke survivors) reported that fatigue may be an important clinical determinant of a progressively disabling pattern of reduced physical activity and/or physical fitness.[30]

Our results show stroke survivors appear to be highly motivated to increase their physical activity on discharge from hospital. However, we know from previous studies that fewer than 30% of stroke survivors will undertake the minimum recommendations of physical activity.[16] The main barriers identified from our study included those likely to reduce self-efficacy. In social cognitive theory[19] control beliefs are conceptualised as self-efficacy. A prospective cohort study within a randomised controlled trial of stroke survivors has

**Table 2** Self-efficacy and intention statements

| **Self-efficacy** 'How confident are you that you will be able to increase your walking over the next month?' | | | | **Intention** 'I intend or plan to walk more over the next month?' | | | |
|---|---|---|---|---|---|---|---|
| | **Group 1** | | **Group 2** | | **Group 1** | | **Group 2** |
| | **Before** | **After** | **After** | | **Before** | **After** | **After** |
| | n (%) | n (%) | n (%) | | n (%) | n (%) | n (%) |
| Not answered | 1 (4) | 1 (4) | 1 (4) | Not answered | 1 (4) | 1 (4) | 1 (4) |
| 1 (least confident) | 0 | 0 | 1 (4) | 1 (strongly disagree) | 0 | 0 | 0 |
| 2 | 2 (8) | 0 | 2 (8) | 2 (disagree) | 0 | 1 (4) | 2 (8) |
| 3 | 6 (24) | 6 (24) | 5 (20) | 3 (neither agree nor disagree) | 2 (8) | 2 (8) | 1 (4) |
| 4 | 7 (28) | 10 (40) | 8 (32) | 4 (agree) | 13 (52) | 14 (56) | 13 (52) |
| 5 (most confident) | 9 (36) | 8 (32) | 8 (32) | 5 (strongly agree) | 9 (36) | 7 (28) | 8 (32) |
| Total | 25 (100) | 25 (100) | 25 (100) | | 25 (100) | 25 (100) | 25 (100) |
| Mean (SD) | 3.96 (0.99) | 4.08 (0.76) | 3.83 (1.13) | | 4.29 (0.62) | 4.13 (0.74) | 4.13 (0.85) |

shown the importance of perceived behavioural control to increasing physical activity post stroke.[20,31] The cohort study showed walking limitations and walking recovery after stroke was predicted by stroke survivors' perceived behaviour control.[20] We have also shown similar results in a qualitative study where we found control beliefs to be a major barrier to physical activity.[32] However, this study was conducted with participants approximately 1 year post discharge from hospital [median 345, IQR = 316–366], so beliefs may have altered.[32]

## Limitations of the study

There are potential limitations to this study. We report on data collected as part of a larger study of the feasibility and acceptability of pedometers to increase physical activity after stroke, which may have introduced some bias as participants had selected to take part in a study about encouraging physical activity. A further limitation was that responses to the questions about self-efficacy and intention to increasing walking could be influenced by the fact that participants were in hospital at the time of the assessment. We know that people in hospital after a stroke spend very little time walking.[33] So participants may have reflected on how much walking they were doing in hospital and therefore felt confident about increasing their walking on returning home. However, stroke is a serious life-changing event for many and returning home from hospital can be daunting. Knowing stroke survivors have high self-efficacy and intention to increasing walking prior to discharge, yet fewer than 30% meet activity guidelines, shows this may be a key time to implement interventions aimed at increasing physical activity after stroke.

## Implications for future research

To our knowledge this is the first study that has interviewed stroke survivors prior to discharge from hospital to determine their self-efficacy, intention, barriers and motivators to physical activity. Most previous studies have recruited stroke survivors approximately 1 year after discharge from hospital. This current study has given valuable insight into the beliefs of stroke survivors prior to discharge. In addition, the study has raised important questions as to why stroke survivors are not meeting physical activity recommendations, even though they appear highly motivated to do so. This study will help to design a behaviour change intervention to increase physical activity after stroke by helping to develop the 'tailored counselling' deemed an essential component of this intervention.[17] Ideally this tailored counselling will be able to maintain this high self-efficacy and intention by tackling the perceived barriers stroke survivors feel towards participation in physical activity.

Fatigue was a significant barrier to physical activity, and we know that this is a major issue for stroke survivors.[34] There is limited evidence about the relationship between physical activity, physical fitness and fatigue,[35] and this study lends weight to the need for further research in this area.

## Conclusions

Self-efficacy and intention to physical activity were high prior to discharge from hospital, yet there are several barriers and motivators to physical activity perceived by stroke survivors. The most commonly reported motivators were 'exercise is good for your health' and 'to improve fitness' and the most commonly perceived barriers were 'having poor health' and 'feeling too tired'. These data have implications for healthcare and exercise professionals who wish to help stroke survivors become more physically active, by allowing targeted interventions to be designed and delivered. It is essential to ensure exercise beliefs and preferences are taken into account when advising stroke survivors to be more physically active. Stroke services need to establish community-based exercise programmes for stroke survivors. These programmes will ideally target the first year post discharge from hospital to help maintain high self-efficacy and intention to walking and, in turn, increase physical activity after stroke.

## References


1 Feigin VL, Forouzanfar MH, Krishnamurthi R et al. Global and regional burden of stroke during 1990-2010: findings from the Global Burden of Disease Study 2010. *Lancet* 2014: 383: 245–54.
2 Stroke Association. *State of the Nation: stroke statistics*. 2017. https://www.stroke.org.uk/sites/default/files/state_of_the_nation_2017_final_1.pdf
3 Caspersen CJ, Powell KE, Christenson GM. Physical activity, exercise and physical fitness: Definitions and distinctions for health-related research. *Public Health Rep* 1985; 100: 126–31.
4 Bernhardt J, Dewey H, Thrift A et al. Inactive and alone: physical activity within the first 14 days of acute stroke unit care. *Stroke* 2004; 35: 1005–9.
5 Rand D, Eng JJ, Tang PF et al. How active are people with stroke?: use of accelerometers to assess physical activity. *Stroke* 2009; 40: 163–8.
6 Saunders DH, Sanderson M, Hayes S et al. Physical fitness training for stroke patients. *Cochrane Database Syst Rev* 2016; 3: CD003316.
7 Lee CD, Folsom AR, Blair SN. Physical activity and stroke risk: a meta-analysis. *Stroke* 2003; 34: 2475–81.
8 Hackam DG, Spence JD. Combining multiple approaches for the secondary prevention of vascular events after stroke: a quantitative modeling study. *Stroke* 2007; 38: 1881–5.
9 Field MJ, Gebruers N, Sundaram TS et al. Physical activity after stroke: a systematic review and meta-analysis. *ISRN Stroke* 2013: Article ID 464176.
10 Cramp MC, Greenwood RJ, Gill M, et al. Low intensity strength training for ambulatory stroke patients. *Disabil Rehabil* 2006; 28: 883–9.
11 Mead GE, Greig CA, Cunningham I, et al. Stroke: a randomized trial of exercise or relaxation. *J Am Geriatr Soc* 2007; 55: 892–9.
12 Macko RF, Ivey FM, Forrester LW et al. Treadmill exercise rehabilitation improves ambulatory function and cardiovascular fitness in patients with chronic stroke: a randomized, controlled trial. *Stroke* 2005; 36: 2206–11.
13 Mudge S, Barber PA, Stott NS. Circuit-based rehabilitation improves gait endurance but not usual walking activity in chronic stroke: a randomized controlled trial. *Arch Phys Med Rehabil* 2009; 90: 1989–96.
14 Billinger SA, Arena R, Bernhardt J et al. Physical Activity and Exercise Recommendations for Stroke Survivors: A Statement for Healthcare Professionals From the American Heart Association/ American Stroke Association. *Stroke* 2014; 45: 2532–53.
15 SIGN. *Management of patients with stroke or TIA: assessment, investigation, immediate management and secondary prevention*. SIGN Guideline 108. December 2008.
16 Shaughnessy M, Resnick BM. Using theory to develop an exercise intervention for patients post stroke. *Top Stroke Rehabil* 2009; 16: 140–6.
17 Morris JH, Macgillivray S, McFarlane S. Interventions to promote long-term participation in physical activity after stroke: a systematic review of the literature. *Arch Phys Med Rehabil* 2014; 95: 956–67.
18 Nicholson S, Sniehotta FF, van Wijck F et al. A systematic review of perceived barriers and motivators to physical activity after stroke. *Int J Stroke* 2013; 8: 357–64.
19 Bandura A. Self-efficacy: Toward a unifying theory of behavioral change. *Psychol Rev* 1977; 84: 191–215.
20 Bonetti D, Johnston M. Perceived control predicting the recovery of individual-specific walking behaviours following stroke: testing psychological models and constructs. *Br J Health Psychol* 2008; 13(Pt 3): 463–78.
21 Johnston M, Morrison V, Macwalter R et al. Perceived control, coping and recovery from disability following stroke. *Psychology and Health* 1999; 14: 181–92.
22 Hellström K, Lindmark B, Wahlberg B et al. Self-efficacy in relation to impairments and activities of daily living disability in elderly patients with stroke: a prospective investigation. *J Rehabil Med* 2003; 35: 202–7.
23 Carroll SL, Greig CA, Lewis SJ et al. The use of pedometers in stroke survivors: are they feasible and how well do they detect steps? *Arch Phys Med Rehabil* 2012; 93: 466–70.
24 Mahoney FI, Barthel DW. Functional evaluation: the Barthel Index. *Md State Med J* 1965; 14: 61–5.
25 Van Swieten J, Koudstaal PJ, Visser MC et al. Interobserver agreement for the assessment of handicap in stroke patients. *Stroke* 1988; 19: 604–7.
26 Mutrie N, Blamey A, Davidson R. *Class based and home based activities for older people*. Scottish Sports Council Report No 32: Edinburgh 1993.
27 Payne A, Greig C, Young A et al. Views of stroke patients on physical fitness training. *Age Ageing* 2001; 30: 429.
28 Gellert P, Witham MD, Crombie IK et al. The role of perceived barriers and objectively measured physical activity in adults aged 65-100. *Age Ageing* 2015. 44: 384–90.
29 Duncan F, Kutlubaev MA, Dennis MS et al. Fatigue after stroke: a systematic review of associations with impaired physical fitness. *Int J Stroke* 2012; 7: 157–62.
30 Loureiro APC, Guarita-Souza LC, Lerdal A et al. A review of the relationship between poststroke fatigue and physical activity. *Topics in Geriatric Rehabilitation* 2014; 30: 296–306.
31 Johnston M, Bonetti D, Joice S et al. Recovery from disability after stroke as a target for a behavioural intervention: results of a randomized controlled trial. *Disabil Rehabil* 2007; 29: 1117–27.
32 Nicholson SL, Donaghy M, Johnston M et al. A qualitative theory guided analysis of stroke survivors' perceived barriers and facilitators to physical activity. *Disabil Rehabil* 2014; 36: 1857–68.
33 West T, Bernhardt J. Physical activity in hospitalised stroke patients. *Stroke Res Treat* 2011; 2012: 813765.
34 Duncan F, Wu S, Mead GE. Frequency and natural history of fatigue after stroke: a systematic review of longitudinal studies. *J Psychosom Res* 2012; 73: 18–27.
35 Duncan F, Kutlubaev MA, Dennis MS et al. Fatigue after stroke: a systematic review of associations with impaired physical fitness. *Int J Stroke* 2012; 7: 157–62.